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THE REPORT

OF

THE BOARD OF HEALTH

ON THE SUPPLY OF WATER

TO THE

METROPOLIS

WEIGHED IN ITS OWN BALANCE

AND

FOUND WANTING.

BY

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THE REPORT, &c.

THE Report of the General Board of Health on the supply of Water to the Metropolis, of 28th May, 1850, commences thus: "May it please your Majesty: The Members of the Metropolitan Sanitary Commission having addressed themselves to the first topic of their enquiry—the preliminary measures requisite for the better drainage of the Metropolis—were proceeding with the second subject of investigation included in the terms of the Commission, namely, the examination of the means for the better supply of the Metropolis with water for domestic use, &c., when their course was interrupted, first by the visitation of the epidemic influenza, and next by the approach of the epidemic cholera," and by their being transformed into a General Board of Health. "It having been submitted to your Majesty that the investigation of the best means of improving the supplies of water, and of arriving at satisfactory and practical conclusions as to the other topics of sanitary enquiry, might be most advantageously completed by the General Board of Health as now organised, with the services of such of its staff of officers as might be made available, the duty of proceeding with this investigation has devolved upon us, and as Members of the General Board of Health we now humbly beg leave to report," &c., &c.

The results of the able official enquiries into the sanitary state of London having made known the fearful condition of the "Water Supply," several private companies were formed with the object of introducing large supplies of better water than had hitherto been available. On the motions for the second readings of the Acts of Incorporation of these companies, they were rejected by the House of Commons at the urgent request of a member of the General Board of Health, on the special plea that the Board were about to propose a scheme for adoption which would be far superior to anything yet brought forward.

As Parliament has thus interfered to check private enterprise, on the special ground of government interference in the subject in question, it becomes necessary to enquire whether the

plans proposed by the Government are worthy of confidence. Now, in this case, the plans proposed may be tested by known data and arithmetical argument, and the result of such an enquiry is to demonstrate that they are so utterly inefficient and vague, that it is impossible that Parliament can give its sanction to them, as a means of correcting the present fearful evils of a deficient and bad supply of water.

The most important part of the Report is, or rather should be, as to the quantity and quality of the water to be obtained.

The Board having been informed that in Lancashire, Yorkshire, and some parts of Scotland, the best and softest supplies of water have been recently obtained by storing the water which runs off the steep and broken sides of sterile ranges of the primitive formations, by throwing an embankment across some natural gorge at the nearest point at which a reservoir may be formed without the expense of excavation (see pp. 84, 85), have adopted the opinion that the best water supply for London is to be obtained from ridges of sand which present no deep natural hollows, and where the excavations for storage reservoirs must be very large and expensive.—p. 113.

The 43rd Conclusion to which the Board have come is as follows, viz.: "That having made careful and extensive enquiries, with the aid of the Department of the Ordnance Geological Survey, as to the most suitable sources of supply, having had those districts which appeared to be the most eligible specially examined by our engineering inspectors, with other aid, we find upon their unanimous testimony that from a tract of upwards of 150 square miles of gathering ground, there is derivable a supply nearly double the present actual domestic consumption, of a quality varying from one-tenth to one-third the hardness of Thames water, and of a purity equalling the general average of the improved soft water supplies of the districts which have yet been brought under examination."

And the 44th is: "That water obtained from silicious sands, such as those which cover the tract above described, is proved to be of a quality only equalled in excellence by the water derived from mountain granite rocks, or slate rocks, or other surfaces of the primitive formations.

At p. 95 we find: "It is reported to us that the quantity lost by evaporation, vegetation, springs, &c., is almost constant, and will range from 15 to 20 inches annual depth."

Where the particular 150 square miles are situated, the Board have not vouchsafed to describe. The only sentence which conveys any information on the subject is the following at p. 100, viz.: "The portion of this district (the Bagshot sands, extending from Esher to Strathfieldsaye, and from Virginia

Water to the high ground above Farnham) to which our attention has been more particularly directed, comprises an area of *less than* 100 square miles, lying east and west of a line from Bagshot to Farnham. The remaining district which we have had under consideration, although of the same bleak and barren character, is of different geological construction, consisting of the upper and lower green sands and gault of the Green Sand Formation, and constitutes the uncultivated sand districts draining into the east and west tributaries of the river Wey, situated south of the chalk ridge in the midst of which the town of Guildford now stands."

With reference to the quantity of water to be derived from these sources, there is the following table at p. 266, "calculated from the extent of area, and from gaugings taken at the end of nearly six weeks of *dry weather*:"—

	Gallons per day.
From surface gathering grounds of sand, comprising specimens averaging from one third to one degree of hardness, and equal in quality to the water delivered at Farnham, from which district, and from streams derived from similar grounds, the average hardness may be estimated as under three degrees	28,000,000
From certain tributaries to the river Wey, containing more water from the chalk, but of a general quality of hardness one third the average of the present supply of the Metropolis	60,000,000
From other tributaries of the Wey, of a harder quality, but only one half of the hardness of the present supply to the Metropolis	90,000,000

There is a large connected extent of waste ground containing about 65 square miles, and extending from the Ascot Downs to Ash, near Farnham, and from Chobham to Finchampstead. The eastern boundary of this ground is exceedingly irregular; the western edge follows the course of the river Blackwater, which in this part flows north-westward.

On the west side of the Blackwater is waste ground extending from Ash to near Winchfield, and from Farnham to Farnborough. Of this there are about 15 square miles.

The last portion is to be distinguished as the Farnham district. Dr. Angus Smith states that the water from this part will average 2½ degrees of hardness. It is soon afterwards remarked to him, as introductory to a question, "From the gaugings taken at the end of *six weeks' rainfall*, it is reported to us that the extent of supply derivable from these wastes, which are distinguishable from the rest, would be about 28 millions gallons per diem."—p. 103.

At p. 108, Dr. Playfair is asked: "Will you state your views in relation to the waters, of which you have made an examination, from between 70 and 80 square miles of these

grounds, the numerical average of which appears to be $2\frac{1}{2}$ degrees of hardness, and which in volume is *stated to promise* a supply of upwards of 28 millions gallons per diem. Supposing this quantity available, how would you class this water as a supply for an urban population?" To which jumble of figures, having little relation to each other, and the leading question which followed them, the doctor innocently answered: "A water of $2\frac{4}{10}$ degrees of hardness is a first-class water, being very much softer than that supplied to most towns in this kingdom."

It will be observed that the "guagings taken at the end of a *six weeks' rainfall*," at p. 103, have passed through the stage of "which in volume are stated to promise a supply of," at p. 108, to the condition of "guagings taken at the end of nearly *six weeks' dry weather*," at p. 266.

Before this 28 millions gallons district is dismissed, the extraordinary fact must be noticed, that no mention is made of the chemical constituents of the water derived from the large Bagshot tract of 60 square miles. The nature of the Farnham water is made very much of, as being from half a degree to $2\frac{1}{2}$ degrees of hardness; but the only reference to the nature of the water derived from the principal gathering ground proposed by the Board is in the following sentence of Dr. Angus Smith's evidence:—"The water from which [i. e. the Bagshot eastern district] as it at present flows is too much colored by peat, and so much so as to be disagreeable to the taste." This is perfectly patent to any one acquainted with the district. Dr. Smith continues:—"I saw abundant reason to think, however, that by careful filtering in its natural position, it could be completely purified, and would then make a valuable gathering ground."—p. 106. What this "careful filtering" is to be, it is difficult to divine; for when, at p. 100, reference is made to the evidence of Mr. Ramsay, the local Director of the Geological Survey, it appears that "Owing to the incoherent texture of the Upper and Lower Bagshot sands, they are easily percolated by water, so that a large portion of the rain that falls on the district must necessarily in the first instance be absorbed." This might be a means of natural filtration. But, at p. 114, the Board says, "It is doubtful whether in some parts, where the sand is very deep, and the present surface is indurated, more would not be lost than gained by breaking through the present surface to underdrain it;" so the Board gravely gets out of the difficulty by proposing to scrape the surface of 75 square miles of the earth's surface to free it from the "hardly objectionable," because "antiseptic," covering of peat. The Board is obliged to make some suggestion, and it is only a suggestion, as to the removal

of peaty impurities from the water, notwithstanding the convenient persuasions of some of their witnesses who say, "The only objections to it are the taste and color, which are disagreeable when the infusion is considerable," &c., because, at p. 81, they had stated that "As popular tests, it is agreed that all special flavor or taste in water is objectionable, as denoting the presence of foreign matters; that the water in which the slightest smell is perceptible should be rejected usually, as tainted with organic matter in a state of decomposition, or some insalubrious mineral matter; that water which has the slightest shade of color should not be used without filtration, as it usually contains earthy or vegetable matter." The filtration, then, must be artificial (i. e. some species of "cooking"); and if so, in what is this water superior to the Henley water, which has but little organic impurity, and may by "cooking" be brought to about 3 degrees of hardness; or how does it even equal the Watford water, which has no organic impurity whatever, and may by cooking be brought also to about 3 degrees of hardness?

The difficulty respecting the 28 millions vanishes, however, into thin air in comparison with the apparition of the two other estimated available quantities, viz.:—

From certain tributaries of the Wey	60 millions.
From certain other ditto	90 „

Now, as already stated, the districts coveted by the Board are, the Bagshot and Farnham, viz., the 28 million district, and the uncultivated sand districts draining into the east and west tributaries of the river Wey, situated south of the chalk ridge.

The watershed which produces the river Wey consists of a well-defined tract of country south of the chalk ridge, and a portion of the Bagshot country north of that ridge. The latter has been already disposed of; and there is therefore only the former tract left for consideration. Let us see what that is. It extends from Leith Hill to Woolmer Forest, and is defined on the southern boundary by a very steep, in some parts almost precipitous, line of hill, overlooking the fair and blooming Weald of Sussex. The entire area includes only about 200 square miles, and if every available drop that fell on it were collected and stored, the produce would be but 72 millions gallons per day, instead of 150 millions. But the Board professes (pp. 114, 115) to take only the waste, and not the cultivated, lands. On the western watershed of the Wey, there are about 45 square miles of uncultivated land. On the eastern watershed there are but 10 square miles of barren country.

So that south of the chalk ridge there are only about 55 square miles available for the purposes of the Board, the remainder of the 200 being generally either well wooded or richly cultivated. The produce of 55 square miles will be but 20 millions gallons, so that if the rain water falling on all the bleak uncultivated lands within the proposed district could be collected, the average produce would be below 48 millions gallons per day. Now the estimated necessary daily supply is 40 millions, the actual present supply being above 44 millions. It is monstrous that the writer of this Report, whoever he be, should attempt such a deception upon the public, as the statement that there is a supply, in the proposed districts, of 178 millions gallons to draw from.—See pp. 265-267. If the entire country comprised within a line from Chobham to Strathfieldsaye on the north, and one from Leith Hill to Odiham on the south, or an area of 500 square miles, were placed at the absolute disposal of the Board, they would then only be able to obtain 179 millions gallons. There has been either intentional deception or an *accidental* addition of one cypher too much to the 2nd and 3rd items of the table at p. 266, as quoted above. Whichever is the case, the Report, as containing a scheme for providing London with an ample water supply, is utterly worthless.

The estimates of available rainfall are made on the supposition of being able to impound 9 inches out of 24 inches, which is about the average fall; and that quantity will, as is shown, produce about sufficient for daily consumption. But the probable variations of the available quantity of rain, as gathered from springs on the Bagshot marly outcrop, may be judged of from the following table of the results of the ordinary and Dalton rainguages for 6 years, from which it would appear that an average of 9 inches out of 24 even cannot be depended on. The following observations were made at Watford :—

Year.	Amount of rainfall.	Amount of available rain indicated by Dalton's guage.
	Inches.	Inches.
1843	26.47	8·10
1144	23·57	9·65
1845	24·53	5·50
1846	26·55	10·27
1847	23·20	4·14
1848	29·69	12·99

From this table it appears that even if in a particular locality the amount of rainfall does not vary much, yet the available quantity for springs, &c., varies from about ⅛ths to ⅝ths. The variation of the annual fall in the Surrey districts has

been from 16·8 in. to 31·7 in. in the years 1847 and 1848 respectively. In the year 1840, also, the fall was about the same as in 1847. Now, in this case, the available quantity will be reduced to 4½ in., or one-half the average and the supply for this enormous metropolis will fall to 24 millions gallons daily. This is not a wild theory, but a perfectly possible contingency, not to be provided against in that district, except by storing a whole year's supply, or by taking power to collect and convey the whole produce of the Wey district, to the utter destruction of its 60,000 inhabitants and their cattle and machinery. If the Board are jealous of the fame of William II., they may certainly rival that eminent Destructive in the formation of the "Newest Forest," as distinguished from the "New Forest."

With respect to the storage reservoirs, it is proposed that they should contain sufficient water for 60 days' consumption; but as there has been occasionally in those districts that length of time without any rainfall, and as the state of saturation of the ground considerably affects the amount of rain which goes to springs or rivers, and as, therefore, after a dry season of 2 or 3 months, the available quantity of rainfall will be very small, it will probably be considered that at least double the proposed quantity must be stored. It must be from pure antipathy to doing anything as it has heretofore been done, that the Board depart from the more usual practice of providing a reserve of 4 to 6 months' supply. If this quantity has been considered necessary in the northern counties where from the nature of the strata, the conformation of the surface, and the much larger amount of rainfall, the rainwater runs off nearly as fast as it falls, much more would it be required in an absorbent soil, where after some months of dry weather, it would require several inches' fall of rain before any could flow from the surface or rise in springs, unless, indeed, the present surface is so much "indurated" that a nearly pure silicious sand comes under the same category as granite or slate.

The two months' supply taken by the Board will require an area of 300 acres, with a mean depth of 30 feet—or the 4 months' supply, which will certainly be insisted on, will require 600 acres, or nearly a square mile, with a mean depth of 30 feet. Now a word as to this *depth*. It is stated at p. 100, "That owing to the incoherent texture of the Upper and Lower Bagshot sands, they are easily percolated by water, so that a large portion of the rain that falls in the district must necessarily in the first instance be absorbed. This circumstance is rendered apparent by the fact that the smaller valleys branching out on either side of the Chobham ridges were, when

visited by me (Mr. Ramsay) destitute of brooks. The water so absorbed is, however, checked in its downward course by the Bagshot marls (No. 2), and when the disposition of the strata is favorable, it is thrown out to the surface at the junction of these marls with the upper sands (No. 1), forming a series of springs round the retentive marly outcrop, and frequently collecting in pools of considerable area, when partially intermingled with the surface drainage." This marly outcrop is generally in the flat country below the hilly districts, and the immense reservoirs have to be entirely *excavated*. If the excavations exceed the depth of the second Bagshot sands, said by Mr. Ramsay to be from 20 to 30 feet in thickness, and by Mr. Austin to be from 5 to 15 or 20 feet thick, and break into the "incoherent texture" of the Lower Bagshots, the depth of which is apparently unknown to the Board, away goes the water, slick! as the Yankees would say, unless, indeed the Board intend to line the reservoirs.

But their estimate of £1,432,000 does not leave much space for "Sundries," after excavating 14½ millions cubic yards for storage reservoirs—covered aqueducts, at least 20 miles in length for one portion, and 30 miles for the other—covered service reservoirs, in duplicate of course, with a week's supply in each set, having, therefore, a cubical content of above a million yards each, with filter beds—principal mains from reservoirs, street and branch mains and services, probably many miles in length, and land for works and compensation.

The object of covering the service reservoirs, and not the storage reservoirs, is not apparent on the Board's arguments. They say, "In respect to vegetable matter, it is to be observed that when water is kept stagnant and exposed to the sun in moderate temperatures, vegetable infusoria of the class called algæ, and also fungoid vegetation, appear rapidly. Many tribes of these vegetable productions appear to die with great rapidity, sometimes in one or two days, and then decompose. Immediately after these, animalcular life appears.

"Light, however, appears to be necessary to the production of infusoria and fungoid vegetation, and their formation is prevented by such covering as excludes the light and heat of the sun.

"Whilst exposure and stagnancy or slow motion thus increase the animal and vegetable impurities in water, they likewise increase its mineral impurities by the increased evaporation which leaves a larger proportion of mineral matter as a residuum."—p. 38.

It might be naturally concluded by ordinary persons that

the process here described would go on much more surely in the gigantic storage reservoirs, than in the smaller service reservoirs, in which a constant circulation and change is taking place.

There can be very little doubt that, with the gentle motion which there will be in the immense storage reservoirs, the marly banks will prove a fruitful place of vegetation, which will produce conditions of vegetable and animalcular life, of far worse nature than a rapid flowing river, beyond the reach of urban drainage pollutions.

At p. 266 of the Report, it is said: "If there can be any reasonable doubt of the sufficiency of supplies from the gathering grounds in question, during periods even of drought, there might still as a matter of necessity be obtained on extraordinary occasions supplies of water from the Thames, or the near tributaries to it, for which some of the old works might be kept up, such as those of the Grand Junction and Vauxhall Companies, with their filter beds, which might be prepared and put in action for an emergency." And again, at p. 267: "The engineering inspectors agree that the two establishments which are the most efficient and eligible, as having superior reservoirs and as being highest up the river, the Grand Junction waterworks on the north, and the Vauxhall works at Battersea on the south side, which now pump water in only during twelve hours out of the twenty-four, might by some alterations, and by rendering their pumping constant, more than double their present delivery, and give a constant supply for a great portion of the metropolis."

What is the description of the water opposite the Vauxhall works? "It contains, at half ebb, ·472 grain of common salt in a gallon."—p. 39. How much at full flood, if the pumping is to be constant? "At high water, at Lambeth, there are 1·256 grain of common salt per gallon." As to some of its other contents, we find, at p. 40, as follows:—"The river water opposite the waterworks at Chelsea (which are opposite the Vauxhall works) contained—

Of inorganic matter	23·10	grains in a gallon.
Of organic and volatile ditto . . .	4·02	,, ,,
	27·12	

"At another time:—

Of organic matter	19·16
Organic ditto.	2·58
	21·74

"Of chloride of silver got 1·15=·238 grains of chlorine, or as common salt ·472.

"The number of animalcules was greater here than at Hammersmith, of the smaller kind, chiefly from $\frac{1}{700}$ to $\frac{1}{400}$ of an inch; with the exception of the naviculæ forming the brown deposit before mentioned. There was also a mass of flocculent brown matter, but it was not very thickly inhabited, it had probably passed the step of most active animalcular life when I examined it, as the amount of matter left material enough for the formation of many little creatures."

But it is said, at p. 42, "that filtration, which consists merely of a process of straining, detains visible animalculæ." Let us turn, then, to some still previous evidence. In the table, at p. 4, it is stated that the Vauxhall and Southwark Company supply the Borough of Southwark and the parishes eastward of the borough as far as Rotherhithe, and south as far as Camberwell, portions of Lambeth and the whole of Battersea." The very head-quarters of the Cholera were included in this district. The Board says, at p. 18: "The evidence cited (respecting the cholera in Rotherhithe and Bermondsey) is derived chiefly from cases in which the water contained an extraordinary amount of impurity; other evidence may, however, be adduced to show the impurity *as well of the distributed pipe water* (i. e. the filtered Vauxhall water) as of the Thames water."

In the evidence of Mr. Challier, a surgeon in Bermondsey, are the following questions and answers:—

"Are not the water butts and other receptacles often placed near the privies?—Yes, very generally.

"Would not that alone be likely to contaminate water that might be pure at its source?—Yes, certainly; *but here it came in with animalculæ in it.*"

The evidence of Mr. Cooper, the chemist, in Blackfriars Road, also proved that the water had a slightly putrescent smell and taste, and deposited matter in vessels in which it was detained.

It may here be remarked that one of the "novelties" of the Board, p. 61, is no novelty in fact. The principle of using an air vessel to obviate the evil effects of hydraulic shocks is a matter of *modern* engineering practice, though the Board apparently hardly believes that a Civil Engineer is capable of effecting such a simple scientific application of known means. When they had Mr. Lindley before them, he could have told them that within the last three years he had used large air vessels between the pumps and the stand-pipes of the Waterworks at Hamburg, to obviate the effects of these shocks.

In the money department, this Report is as singular as in the water statistics.

At p. 284, it is said that "with reference to domestic savings, by the use of soft instead of hard water, the expense of soap will be reduced one-half." At p. 77 it is stated on the authority of Mr. William Hawes, that the consumption of soap in London is about 800 tons per month at £45 per ton; or a total expenditure of about £452,000 per annum. The *saving*, therefore, would be about £226,000 per annum.

At p. 321, it is stated, in the 46th Conclusion, "the saving in soap from the use of soft water in the operation of washing, would be probably equivalent to the whole of the money expended at present in the water supply." In 1826, the average rate on 120,000 houses was £1 9*s.* 3¾*d.*; in 1833 it was £1 10*s.* 1½*d.* on 191,000 houses. The rates have certainly not been lowered since then, and as there are now above 288,000 houses in the metropolis, and the average water rate levied by all the companies may be moderately taken at £1 9*s.*, the total annual expenditure in water, and therefore the total saving in soap would be about £417,600. As the pages of the Report increase, the figures multiply strangely. The principle of this is, perhaps, *dramatically* correct.

At p. 72 it is stated that a great drawback to a proper degree of washing amongst the middle and lower classes is found in the expense; and "that expense is materially augmented by the waste of soap occasioned by hard water. This waste amounts to 25½ oz. of soap in the use of each 100 gallons of water of 16° of hardness over and above that which would be required with a water of 4° of hardness, or an extra cost of 8*d.* on each 100 gallons or of 6*s.* 8*d.* on each 1,000 gallons." If cold water were used for washing clothes, this might pass; but as very much of the argument of the Report is founded on such supposed facts as the above, it becomes necessary to point out the fact that clear running brooks are not numerous in London, and that for the greater part of the clothes washed in laundries and private houses, hot water is used and in heating the water the lime is deposited in the kettles and boilers, until in fact a great part of the above imaginary loss disappears.

At p. 48 the Report itself when arguing upon the evils of lime in water states that "the importance of this mineral ingredient is only to be correctly estimated when viewed in the aggregate, when the 16 grains per gallon become in the day's supply of 46 millions, 26 tons of lime, which we find affecting every domestic operation, and see accumulated as a coating in kettles, in the pipes of baths, in the boilers of steam engines and so on." And yet when another argument has to be founded on the waste of soap, it appears that this lime is

not deposited in the kettles or boilers, but remains in solution in the water, in order to counteract soap. Very spiteful!

But supposing the water used were all cold. Assume Dr. Clark's estimate to be correct that the quantity of water used in washing clothes amounts to 400 gallons per annum per individual. Only half that quantity is used with soap, the rest being used for rinsing &c., so that the loss according to the writer of p. 72 of the Report would be 1*s.* 4*d.* per head per annum, or a total of £150,000, in a population of 2¼ millions. Thus the saving in soap by using a soft water instead of Thames water, according to p. 72, would amount annually to £150,000;
according to p. 284, „ „ £226,000;
and according to p. 321, „ „ £417,600.
Against this it may be stated that Professor Clark's estimate of the saving of soap in London by the use of a softer water than that which is at present distributed, would be £63,000.

Though not disposed to say much in favor of the water distributed at present in London, it is impossible to refrain from remonstrating against the manner in which the assumption that the Thames and New River waters are of an average hardness of 16°, is made use of and worked up all through the Report. At p. 49 occurs the following sentence:—"Whilst the average of the waters found available for new districts (in the country) was about 8° of hardness, the average of a set of analyses procured from Professor Brande, of Thames water supplied by the Companies was 16°. Dr. Lyon Playfair has not found the hardness of his average specimens of Thames water quite so high. But there was reason to believe, as is shown in the report of Dr. A. Smith, that the reduced hardness which was found in the specimens taken from near the metropolis was occasioned by the excess of animal refuse and other pollutions. The waters of the river Lea and those supplied by the New River Company are essentially of the same character as Thames water in respect to hardness."

Nothing is said in support of the assumption beyond the above bare assertion. Neither Brande's nor Playfair's analyses are given in the Report. Professor Brande's analyses were of 17 samples, and the hardness varied from 14⅒ to 17, the average being 15·79.

In the minutes of evidence with the Report of 1844 at p. 4, Professor Clark gives the following account of the hardness of waters—his experiments being made in 1841:—"I found in the New River 13⅗° of hardness. In August, I found in the New River 12°. In the Thames opposite Mortlake I found 14⅘°. From a great variety of trials that I made from the waters collected from various pipes in town I found the hardness of Thames water 11⅘°. The Thames water and the

New River Water may in general be reekoned of 12° of hardness.

If, therefore, assuming the East London Company's water to be about 16° of hardness, the average for the rest of London be placed at 12° instead of 16°, the waste of soap must be redueed from an average of 25½ oz. to 19 oz., and the climaeteric savings are reduced to £117,187, £226,000 and £417,600.

With respeet to the quantity proposed to be given to eonsumers by the new system, suffieient evidenee is not given to warrant the reduetion from all previous estimates of 100 gallons per house to 75 gallons.

The experienees of various towns in the north are appealed to, to show that about 25 gallons per house is the ordinary eonsumption of the middle elasses. But for many reasons they are no guide for the wants of London; and indeed the evidenee given in with respeet to the disposal of the 146 gallons now daily delivered by the Companies shows that above 50 gallons are used for domestie purposes in London. In a large bloek of 1200 houses, near the Regent's Park, of whieh none were of the higher elass, many of the poorer elass, but the average of the middle elass, the average eonsumption as aseertained from the guagings of the butts and eisterns was 51½ gallons per diem. In the northern eastern distriets, Mr. Gotto says that the average quantity of water aetually eonsumed per house is about 9½ eubie feet or 62 gallons in the lower neighbourhoods. The question now is only as to the eonsumption per house. The diseharges on 4 days of the week are given, from 380 houses near the Caledonian Road, and they vary from 40 to 104 gallons, but the fair average day is the Thursday (not a water day) and then it was 50 gallons. In John Street, Edgeware Road, 66 gallons per day is given as the eonsumption. In Park Plaee, St. James, in 9 large houses, the quantity used is said to be 407 gallons eaeh per day. In the poor easterly distriets the eonsumption is about 50 gallons per day. In the Southwark low elass distriet, it is stated that the usual eonsumption is but 20 to 30 gallons, but that every twentieth house is a baker's or buteher's, or a publie house, for which about 143 gallons is required.

Now there are about 264,000 houses in London whose rentals vary from £10 to £100; 16,700 varying from £100 to £200; and 7,300 with rentals from £200 to £1,000 and above. Then giving an average to the first of 50 gallons, to the seeond of 150 gallons, including baths, stables, &c., and to the third, of 300 gallons, we have an average eonsumption of 59 gallons per house. But it is amongst the 264,000 houses that the great desire of all Sanitary Improvers is to extend the use of water, and promote eleanliness, and if only that great desideratum for health, and appropriate eompanion of a eonstant

supply, viz., the bath, were introduced into one-half of these houses, and the same allowance for one bath per day be given that is used at the Marylebone baths, viz., 50 gallons, and an additional allowance for baths to the second class of houses be made, the total average per house in London mounts at once to 90 gallons. For this reason the strongest possible protest ought to be raised against any project which promises less than 100 gallons per house per day in London. Less than this, would be defeating much that Sanitary Reformers have been struggling for during many painful years; less than this, it may be positively asserted, the Board of Health would never have sanctioned, but for the vain desire to make a certain tract of country effect a certain purpose.

The following extract is from p. 265:—"It is estimated that the following quantities of water would meet the present necessities of the metropolis:—

	Gallons.
1. An improved domestic supply of 75 gallons per diem to 288,000 houses	21,600,000
2. Supply for new Baths	1,000,000
3. Supply for the general surface cleansing of courts, foot-pavements, and the carriage ways of paved streets, and street watering	10,000,000
New demands for brewers and other large consumers	4,000,000
Fires and contingencies	3,400,000
	40,000,000."

The value of the 1st item has been disposed of. The 2nd item is marvellously small, considering that one establishment of baths alone is constructed for the consumption daily of 150,000 gallons. A moderate estimate of the demands for new baths ought not to be lower than two millions. As to the 3rd item, it appears at p. 143, that at Wolverhampton, where there is constant supply and economical management, the expenditure for such purposes, and including *washing out service pipes and waste* is 51 gallons per house. This item should, therefore, be at least 14,400,000. But in designing a system of water supply which is to be permanent for London, is the possibility of some day acquiring the benefits of public fountains to be precluded? Is the Londoner never to see even in prospect his city ornamented, its atmosphere refreshed and its health improved by such pleasant means? Is the country-born artisan, deep buried in the miasmata and sloughs of the metropolitan working districts, never to find in this huge city some fancied realisation of the weak memories of those running streams and bubbling fountains that his childish eyes loved to watch?—Oh! ye ruling magnates, for the love of heaven and that glorious nature which is dear to the poor man as to yourselves, and which you can enjoy in peace and leisure, remember the toiling artisan, give him

bright light, give him fresh air, give him clear running water, and you give him health and cheerfulness for his lot, and will unfailingly draw down unnumbered blessings on yourselves.

It appears from the grounds mentioned that the table last quoted should stand thus:—

	Gallons.
1. An improved domestic supply of 100 gallons per diem to 288,000 houses	28,800,000
2. Supply for new baths	2,000,000
3. Supply for the general surface cleansing of courts, foot-pavements, and the carriage ways of paved streets and street watering, *fountains, and the washing out of service pipes and waste*	17,000,000
New demands for brewers and other large consumers—moderate at	4,000,000
Fires and contingencies	3,700,000
	55,500,000

The neeessary "improved" supply then for the metropolis cannot be estimated at less than 55½ million gallons daily. And this amount eannot be obtained from a traet of eountry whieh only prodnees on the *average* 47 millions, and whieh in some seasons affords only 24 millions gallons.

Suffieient ease has, I submit, been shown for an earnest appeal to Parliament to rejeet with promptitude any sueh seheme of water supply for the metropolis as that whieh has been proposed to the exclusion of all others by the General Board of Health; but the remarks on this Report eannot be closed without a remonstranee against the gross personalities indulged in from beginning to end. Not eontent with asserting generally that professional men have eondueted their operations on mere empirieal knowledge, and that aeting solely with the view to the benefit of their own poekets, they eare nothing so that they can fleece the publie, they deseend to personal attaeks. The Board of Health sitting in their eushioned chairs in Gwydir House, are of eourse perfeetly ignorant of the many painful hours of toil and anxiety, of the eontinual exposure to extremes of temperature, and to the raging storm and soaking damp, or to the more dangerous miasma and insidious fevers, whieh the praetieal English engineer is eontinually exposed to, but whieh he eheerfully eneounters, in the promotion of the well-being of his eountry, his fellow ereatures, and his employers, and for whieh he but too frequently reeeives in return ill treatment, dishonoured bills, and eontumely, in addition to disease and prematnre infirmities.

The only person or thing in the shape of an engineer who is civilly spoken of in the Report is Captain Vetch, who is three times lauded to the third heavens. Far be it from me to disparage by one word the talents of that eminent officer; but few people outside of Gwydir House will be disposed to

rank him above the accomplished gentleman and engineer, Robert Stephenson, who is mentioned at p. 270 for an implied reprimand.

The contemptuous reference which is more than once made to Mr. W. Cubitt and Mr. James Walker, men to whose judgment many important Government functions have been and are confided for decision, is, to say the least, indecent from any Public Board.

To descend to smaller fry, nothing can be more disgraceful than the manner in which they hold up to ridicule a Corporation Officer, for the use of an expression, which from the mouth of one of their own officers would have been quoted as a cutting piece of irony on the effects of bad drainage; and in fact an unprejudiced mind cannot read the sentence without putting such a construction on it.

At p. 44 is the following:—"The witness on behalf of the Lambeth water company, Mr. Richard Phillips, the Chemist, when questioned as to whether the water there delivered might not be objectionable on account of the quantity of offensive animal matter which it contained, says 'it would not be so pleasant;' as if the subject were, from the incidental or occasional use of the water, one of no great moment affecting only some few people."

Against this the following may be quoted from p. 105:—The witness on behalf of the General Board of Health, Dr. Angus Smith, the Chemist, when questioned as to whether the water to be collected from the Surrey wastes might not be objectionable on account of the infusion of peat which it contained, says, "No, it is not thought so. The only objections I know to it are the taste and color, which are disagreeable when the infusion is considerable;" as if the subject were from the incidental or occasional use of the water, one of no great moment, affecting only some few people. Sneering should be impartial.

A remonstrance must also be made against the 45th conclusion which states that the Surrey water may be delivered at constant high pressure in London, and taken away again by a proper drainage system for a charge of 3*d.* or 4*d.* per week per house; whereas that cannot be done as the Board propose without first buying up the plants of the old companies, a charge which will probably double the rate mentioned.

In conclusion, I will state that my reason for investigating and exposing the fallacies of this Report, is to do what lies in my power to prevent the public adoption of any course which would tend to retard the attainment of the much desired object of an *efficient supply of good water* at constant high pressure over the whole of this metropolis.

GENERAL BOARD OF HEALTH.

REPORT

ON THE

SUPPLY OF WATER

TO

THE METROPOLIS.

APPENDIX No. I.

RETURNS TO THE QUERIES ADDRESSED TO THE SEVERAL METROPOLITAN WATER COMPANIES.

Presented to both Houses of Parliament by Command of Her Majesty.

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